

Commencement Address, The Ohio State University, March 19, 1982, Daryle H. Busch, Professor of Chemistry - S

Mr. President, Honored Guests, University Leaders, Faculty, Graduates, and Families and Friends of Graduates

Graduates, this is your day and everything we say or do should be intended to enhance this special occasion for you. You know that all of us wish you health, happiness and career fulfillment.

Before proceeding, let me say a few words to the immediate families of the graduates -- especially to parents and spouses. Together you and we share great pride in these people and in their accomplishments. They know, just as you and I know, that your caring support has had a lot to do with bringing them to this graduation day.

I've thought a lot about you graduates during the past month or so and I usually wind up thinking about your careers and your citizenship. In a very real sense your graduation signals one more step in your accepting your natural collective inheritance -- the managing of this world of ours.

It is a very confusing thing, this modern world, this modern nation, this state. I want to wish you the analytical capability and perspicacity to penetrate to the core of issues and the steadfastness to persist in maintaining the purest of standards as you go thru life.

Among the greatest sources of confusion is the profusion of issues and organizational components in our society. I wish you the wisdom to not confuse the general character of the many organizational components. There are few that deserve eternal existence and then there are many that are the products of time and place, though often of great temporal importance. The first are the basic and enduring institutions of your society (BEI). I list among these the

family; your constitution and bill of rights based, power separated democracy; and your schools and universities. Of course there are others. The contrasting societal components are the organizational paraphernalia of this era (OPE). EPA and DOE are/were among these. I encourage you most sincerely to always support your BEI and to select very carefully as you give your support to various OPE.

As these OPE operate, they often are the rallying points for highly emotional issues. In fair measure they reflect what all of us recognize to be an uncomfortable characteristic of our free society. I think of it as an oscillation having an *excessive amplitude*. Example: first we build a great industrial establishment and, in so doing, we make parts of our country uninhabitable. Then we recognize the problem, so we work hard to restore the habitability of those regions without regard to the health of the industrial establishment. It would be marvelous if during the prime of your time, ways were found to smooth out these devastating oscillations while sacrificing little in the way of personal freedom.

Your lives are changing greatly just now. Soon many of you will go on to your first jobs. I remember when I went to work in my first and only full time job, on this faculty. My greatest fear was that after having struggled so long and hard to get a chance at a career, I would die before I found out if I could do the job. Now I look at you and your situation. You have such heavy additional burdens: a polluted land, the shadowy threat of nuclear holocaust, a new draft, the possibility of unholy miniwars, our faltering economy, and what else? From my experience, I would say that mortality is burden enough for any striving and sensitive young person.

On the other hand hasn't there always been adequate basis for fear and distress if one were of a turn of mind to seek it or to succumb to it? Invariably,

one must learn to live with the fears that are indigenous to his or her time.

As we look to the future together, many of the problems we face are technological in character. Economically, we must compete in an arena increasingly dominated by so-called high technology. Energy needs, environmental protection, and the balance between them are all high technology. The computer-automated production industry is high technology. The increasing emphasis on smart machines in the consumer field is high technology. The immense business of computer-based information management is high technology.

The question of the scientific literacy of Americans is germane to the confronting and resolution of the many issues relating to our technological world. According to Frank Press, President of the National Academy of Sciences, studies show that the quality of education in science of the general population is falling. It is very difficult to teach the foundations of any science even to good students at a fairly advanced level. Yet, the average citizen is going to get his/her impressions of science from high schools and earlier. In contrast to what has been provided for them in the past, I believe that American citizens have a great need to understand the true character of science and the basic concepts and experimental bases for certain very general scientific areas. To quote from D. Allan Bromley, immediate past president of the American Association for the Advancement of Science, "that the term *creationist science* and what it implies can be taken seriously by so many people is perhaps the most damning indictment we currently have of our failure in science education."

How could our society try to put an end to this prevailing scientific illiteracy? In my opinion, scientists would have to work with teachers and educationists and extensive programs for the use of these innovative materials would need to be developed and funded at both the National and local levels. The

positive effects are a generation away so the effort needs to begin now. Perhaps this call for new money seems like a bizarre suggestion during this era of tax-payers revolts, when even the basic funding for education is failing. I believe that we must always invest some of our resources in tomorrow.

Scientific and engineering manpower is another closely related problem area and the greater problems lie in elementary and secondary education. One must question whether those educational systems are capable of preparing a sufficient number of qualified students for the study of science and engineering in our colleges and universities.

The latest National Research Council study entitled "The State of School Science" shows a number of alarming facts

1. Only one-third of the nation's high schools offer more than 1 year of mathematics and/or science.
2. At least half of the US high school graduates have taken no more than one year of biology, no other science and no mathematics beyond algebra.
3. Advanced math is taken by only a small minority of high school students in the US.
4. Money problems have cut in half the number of high school science students who receive any laboratory experience.
5. And as often quoted, average Scholastic Aptitude Test scores for high school seniors continue to fall. Also, the fraction having high scores (>600) is decreasing.

The areas of science and engineering are definitely under subscribed by students in our universities, even though jobs for graduates are readily available and salaries are high, especially in engineering. Inducements to accept employment in industry are so great that few American engineering graduates

go on to graduate school. This is producing a shortage of persons qualified for faculty jobs in the field. In Bromley's words, we are eating the seed corn.

In physical science and engineering the percentage of recent PhD. graduates (Ph.D. within 7 years) on faculties in universities has fallen drastically in recent years, from 39% in 1968 to 21% in 1980. Such a short-fall of persons entering science and engineering is not happening in Japan or Germany, our strongest economic competitors; nor is it true of our traditional rival Russia. Those societies are committing greater percentages of their resources to this area and the results are evident. For example, Japan graduates 5 times as many engineers as does the US.

At this point I wish to direct my comments to topics that relate more specifically to your university, OSU and, for these comments, I might hope that this marvelous audience includes members of our state government. Friends in Europe and Britain have told me on several occasions that the really old universities were always established in small towns at forbidding distances from the capitals of the countries or provinces so that the student and faculty activists could pose no threat to the government. Maybe the separation worked well in two ways. The isolation may have sheltered the universities. We at OSU do not enjoy the advantage of being sheltered.

I see two main reasons why universities need such sheltering. First, issues are not the business of universities. But our mission to deal in knowledge is apolitical and terribly sensitive issues do sometimes arise quite naturally in the course of scholarly activity. A second reason is financial. It takes a long time to build quality into a university, even given adequate resources. Brief removal of those resources can have catastrophic effects on that quality.

The Ohio State University is not traditionally sheltered whether in the academic sense or in the financial sense. A persuasive person at the University

of Minnesota once explained to me that his school is a separate branch of the state government. He alleged that this produced certain financial advantages, including stability and flexibility. The great tradition of academic protection enjoyed by the University of Wisconsin caused that school to be less affected by the turmoil named for Wisconsin's junior senator McCarthy than was the case at several other universities, including ours.

At different times in the past, OSU may have suffered because her academic freedom was not adequately protected; however, the obvious crisis of today stems from the fact that our state government all too often leaves the institution on the brink of financial disaster. The implicit assumption is that OSU will be ok regardless of the vagaries of her funding. The normal functions of a university cannot simply be turned on and off like a light switch.

I won't recount the maddening meandering that state funding has followed during the past 14 months. I will only say it must be terribly frustrating for legislators to have braved the possibility of tax-payers revolt and then learn that their work has provided only two months of fiscal soundness for the state, followed by a return to the original dilemma.

The message that I really want to deliver on this matter is --there must be a way to establish some stability in the funding base for Ohio's universities. There must be some alternative to the present practice of keeping these institutions in an almost constant state of oscillation between normal funding and drastic cut-backs.

What is this disaster that I contend can follow from erratic funding of your university? It is simple. The quality of a university is determined by the quality of the faculty and students and the scholarly opportunities that are available to them. First one destroys the scholarly opportunities then one drives away the most mobile faculty.

If the new medicine, the new technology, or science, or the most creative in arts are to come from your institution, then you must have some of the people who produce these innovations. There is no leadership in the absence of people who are leaders. There is a market-place and the rest of the world is competing for these people.

Finally, I must direct some thoughts toward our university administration.

The powers of university leaders to affect the excellence of the teaching and research that goes on in their institutions are enormous. But in any given institution there are built-in tendencies, and like free energy, the spontaneous tendencies are generally negative. I recall a friend of ours lamenting that he repeatedly tried to build towers of excellence at OSU but most often had to watch them slump back to a great plane of mediocrity. Mediocrity has a strong sense of survival and it has time to promote its cause.

I think that OSU needs to build into its structure some component dedicated to the detection, assessment, and preservation of excellence. As regards your chances of success in producing a truly outstanding university, I offer the proposition that it is not the administrative powers that you wield but the professorial powers that you unleash that are most important. Other universities not too different from ours have enlisted their faculties in the struggle for excellence and I sincerely hope some such practice will be adopted here.

Returning to fiscal matters only briefly, there remain some ways in which OSU could help herself a bit more. For example, while we read about highly successful, impressively large, alumni fund drives, OSU has never attempted a major campaign of this kind. Also some universities enjoy very substantial incomes from royalties on patents. Our university should consider strong incentive programs in this area to stimulate the generation of intellectual properties.

Repeatedly I have referred to other schools and maybe I left the wrong impression. I'm not willing to say that any of these places is necessarily as good, never mind better than us.

I again wish you graduates bright and happy futures. I want to close with a lay prayer for us all. It is by Bernice Lever, editor of the Canadian literary magazine Waves.

I don't want to live
everyday
as the last day
grasping and clasping
at disintegrating care
like a fish leaping
from an oil slick
into our polluted air.
Grant me the wisdom
to live each day
as the first day, :
shy in its newness
strong in its promise.

Thank you very much!